1. An apparatus for wavelength-shift multiplexing, the apparatus comprising:

a first photonic path configured to carry a first photonic signal;

a narrowband filter configured to bandpass filter the first photonic signal to provide a first narrowband photonic signal;

a wavelength shifter configured to wavelength shift the first narrowband photonic signal to provide a first shifted photonic signal; and

a second photonic path configured to carry the first shifted photonic signal.

2. The apparatus of claim 1, further comprising:

the second photonic path further configured to carry a second shifted photonic signal;

the wavelength shifter further configured to wavelength shift the second shifted photonic signal to provide a second unshifted photonic signal;

the narrowband filter further configured to bandpass filter the second unshifted photonic signal to provide a second narrowband photonic signal; and

the first photonic path further configured to carry the second narrowband photonic signal.

3. The apparatus of claim 2, wherein the narrowband filter comprises:

a circulator configured to circulate the first photonic signal and provide a first circulated photonic signal;

a reflecting filter configured to selectively reflect the first circulated photonic signal to provide a first reflected photonic signal;

the circulator further configured to circulate the first reflected photonic signal to provide the first narrowband photonic signal;

the circulator further configured to circulate the second unshifted photonic signal to provide a second circulated photonic signal;

the reflecting filter configured to selectively reflect the second circulated photonic signal to provide the second reflected photonic signal;

the circulator further configured to circulate the second reflected photonic signal to provide the first narrowband photonic signal; and

4. The apparatus of claim 1, wherein the wavelength shifter is further configured to receive a shift signal and provide a wavelength shift between the first narrowband photonic signal and the first shifted photonic signal in proportion to the shift signal.

5. The apparatus of claim 4, wherein the shift signal is characterized by a function selected from the group consisting of a spreading function, a gathering function, and a range of allowable wavelength shifts.

6. The apparatus of claim 1, wherein the wavelength shifter comprises:

a photonic input path configured to carry a photonic input signal comprising an input channel, having an input wavelength definable as a function of time;

a photonic output path configured to carry a photonic output signal comprising an output channel, having an output wavelength definable as a function of time;

a modulation device configured to modulate the photonic input signal in accordance with a modulation waveform to provide the photonic output signal;

a modulation synthesizer configured to provide the modulation waveform to the modulation device effective to shift the input wavelength to the output wavelength;

a wavelength error detector configured to detect errors in the output wavelength and to provide to the modulation synthesizer an error signal configured to correct the output wavelength.

7. The apparatus of claim 6, wherein the modulation waveform is selected from the group consisting of a substantially sawtooth shape and a substantially triangular shape.

8. The apparatus of claim 6, wherein the wavelength error detector is configured to perform a step from the group consisting of selectively tuning to an arbitrary wavelength, detecting the channel wavelength errors in the representative channel from the photonic output signal, and averaging the wavelength errors of multiple channels.

9. The apparatus of claim 6, wherein the modulation device is selected from the group consisting of a phase modulator and quadrature amplitude modulator.

10. The apparatus of claim 9, wherein the quadrature amplitude modulator comprises an upper branch and a lower branch, each having a transfer function, the modulation waveform being a quadrature waveform comprised of upper and lower waveform components corresponding to the upper and lower branch, the upper and lower waveform components being substantially 90 degrees out of phase.

11. The apparatus of claim 10, wherein the upper and lower waveform components each have a value selected from the group consisting of substantially a sinusoid divided by the respective transfer function corresponding to the respective upper and lower branch, substantially a sawtooth shape, and substantially a triangular shape.

12. A method for wavelength-shift multiplexing comprising:

providing a first photonic signal;

narrowband filtering the first photonic signal, thereby providing a first narrowband photonic signal; and

wavelength shifting the first narrowband photonic signal, thereby providing a first shifted photonic signal.

13. The method of claim 12, further comprising:

providing a second shifted photonic signal;

wavelength shifting the second shifted photonic signal, thereby providing a second unshifted photonic signal; and

narrowband filtering the second unshifted photonic signal, thereby providing a second narrowband photonic signal.

14. The method of claim 13, wherein narrowband filtering comprises:

circulating the first photonic signal to provide a first circulated photonic signal;

selectively reflecting the first circulated photonic signal to provide a first reflected photonic signal;

circulating the first reflected photonic signal to provide the first narrowband photonic signal;

circulating the second unshifted photonic signal to provide a second circulated photonic signal;

selectively reflecting the second circulated photonic signal to provide a second reflected photonic signal; and

circulating the second reflected photonic signal to provide the second narrowband photonic signal.

15. The method of claim 12, further comprising providing a shift signal and wavelength shifting the first narrowband photonic signal in proportion to the shift signal.

16. The method of claim 15, wherein the shift signal is characterized by a function selected from the group consisting of a spreading function, a gathering function, the difference of two spreading functions, and a range of allowable wavelength shifting.

17. The method of claim 15, wherein wavelength shifting comprises:

providing a photonic signal;

providing a modulation waveform;

modulating the photonic signal with the modulation waveform, thereby providing a shifted photonic signal;

providing a wavelength reference;

comparing the wavelength reference with the shifted photonic signal to provide a wavelength error signal; and

adjusting the modulation waveform in proportion to the wavelength error signal, thereby correcting wavelength errors in the first shifted photonic signal.

18. The method of claim 17, wherein modulating comprises a step from the group consisting of phase modulation, quadrature amplitude modulation, providing a modulation waveform substantially sawtooth in shape, providing a modulation waveform substantially triangular in shape, providing a modulation waveform as a quadrature waveform comprising first and second waveform components substantially 90 degrees out of phase, and a combination thereof.

19. An apparatus for wavelength-shift multiplexing, the apparatus comprising:

a plurality of photonic signal paths, each photonic signal path thereof configured to carry a photonic input signal comprising a selected narrowband signal;

a plurality of photonic transceivers, each photonic transceiver thereof configured to extract and wavelength shift the selected narrowband signal, thereby providing a plurality of channelized photonic signals;

a combiner-splitter configured to combine the plurality of channelized photonic signals, thereby providing a multiplexed photonic output signal; and

a multiplexed photonic signal path configured to carry the multiplexed photonic output signal.

20. The apparatus of claim 19, wherein each photonic transceiver comprises:

a first photonic path configured to carry a first photonic signal;

a narrowband filter configured to bandpass filter the first photonic signal to provide a first narrowband photonic signal; and

a wavelength shifter configured to wavelength shift the first narrowband photonic signal to provide a first shifted photonic signal.

a second photonic path configured to carry the first shifted photonic signal;

sawtooth in shape.